POSTER PRESENTATION



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A phase-locked loop epilepsy network emulator for localizing, forecasting, and controlling ictal activity

Patrick D Watson^{1,2*}, Kevin Horecka¹, Rama Ratnam^{4,5}, Neal J Cohen^{1,3}

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Seizure detection is rapidly improving thanks to novel computational approaches [1] and public databases of electrocorticography (ECoG) data [2]. But these approaches rarely model the high-frequency oscillations that underlie seizure pathology [3]. In the current work, we employ a phase-locked loop (PLL) neural network [4] to emulate a mesoscale circuit undergoing highfrequency oscillation. We phase-lock the nodes of the emulator to raw voltages recorded from chronically implanted ECoG electrodes in a canine model of epilepsy, and demonstrate that the emulator experiences uncontrolled phase oscillation far in advance of either behaviorally observed seizure activity or fluctuations in ECoG voltages. Using distance weighting to train the epilepsy network emulator, we localize the ECoG electrodes responsible for destabilization, and present measures sensitive to these phase disruptions to establish a forecasting period for ictal activity. We discuss how phase oscillations from real-time epilepsy network emulation could serve as a closed-loop feedback control signal to interrupt ictal activity.

Authors' details

¹Beckman Institute of Science and Technology, UIUC, IL, USA. ²Neuroscience Program, UIUC, IL, USA. ³Department of Psychology, UIUC, IL, USA. ⁴Coordinated Science Laboratory, UIUC, Urbana, IL, USA. ⁵Advanced Digital Sciences Center, Illinois at Singapore Pte. Ltd., Singapore.

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* Correspondence: pwatson1@illinois.edu ¹Beckman Institute of Science and Technology, UIUC, IL, USA

Full list of author information is available at the end of the article



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